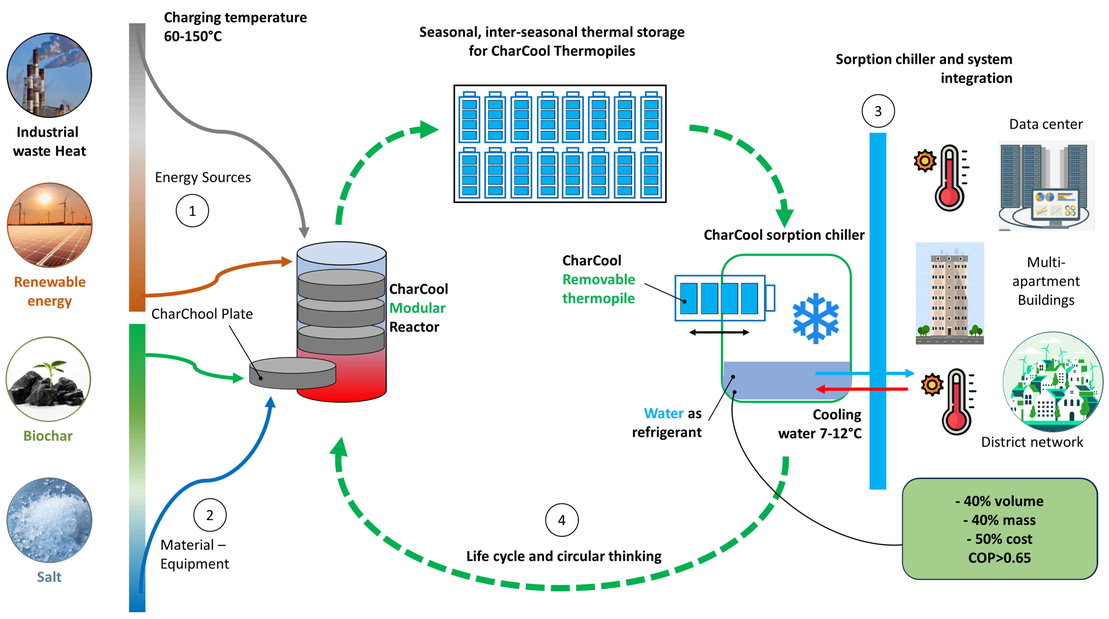
Rethinking the future of clean cooling through a revolutionary class of thermally-driven chiller based on a novel bio-based thermochemical material

THE PROJECT

CharCool is an innovative project aimed at developing a new class of affordable, compact, and efficient water-based sorption chillers for air conditioning and data centre thermal management. The project focuses on a ground-breaking modular thermopile, utilizing a novel, inexpensive, high-energy density, and environmentally friendly Thermochemical Material (TCM). The proposed system outperforms current refrigeration technologies, reducing both the volume (by 40%) and cost (by 50%) of conventional sorption chillers. During the project, the key building blocks for this technology will be developed, optimized, and advanced to TRL4.

THE APPROACH



THE OBJECTIVES

1. Develop a novel Thermochemical Material (TCM) for cooling/heating application.
2. Design a modular environmentally-friendly TCM-based thermopile.
3. Demonstrate the integration of the CharCool TCM thermopiles in sorption chiller technology.
4. Assess circularity indicators allowing to validate proposals to improve the system and the environmental impacts by common life cycle assessment (LCA) indicators.

PROJECT FACTS

Start: **October 2024**
Duration: **4 years**
Budget: **€ 3.857.353,75**
Consortium: **6 partners**

CHARCOOL

THE CHALLENGE

The increasing global demand for cooling, driven by factors like population growth and rising temperatures, poses a significant challenge. A business-as-usual approach will lead to higher greenhouse gas emissions, either through refrigerant leakage or fossil fuel use to power cooling systems. To address this, new cooling technologies are urgently needed that focus on improving energy efficiency and utilizing renewable energy sources.

THE SOLUTION

CharCool is a sustainable, heat-driven cooling system that stores clean renewable energy or waste heat in a modular thermochemical energy storage system, enabling seasonal storage. It challenges traditional cooling methods by using a flexible and reliable system powered by a high-energy density (200 kWh/m3), inexpensive thermochemical material. The chiller utilizes new modular thermopiles made from environmentally-friendly materials, with water as the refrigerant for a safe, natural alternative to conventional electricity-driven cooling solutions. Operating on waste heat or renewable energy sources within 60-150°C, CharCool reduces reliance on the electricity grid, enhances renewable energy integration, and bridges the spatial and temporal gaps between heat sources and cooling demand.

THE EXPECTED IMPACTS

The CharCool technology lends itself well to different applications, including:

- Integration in industrial processes to recover waste heat.
- Application in multi-apartments buildings/commercial buildings to increase the renewable cooling/heating production by means of solar energy.
- Coupling to district heating networks.
- Data centres cooling and waste heat recovery.

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www.charcool.eu

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